

**Basewide Energy
Systems Plan For
Fort Gillem, Georgia**

Final Report

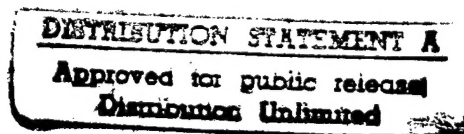
Executive Summary

Facilities Engineer

Prepared For:

Conservation Measures

**Savannah District
Corps of Engineers**



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July 1985

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BASEWIDE ENERGY SYSTEMS PLAN
FOR
FORT GILLEM, GEORGIA

FINAL REPORT
EXECUTIVE SUMMARY
INCREMENTS A, B, F, AND G

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Army Contract No. DACA21-80-C-0014
JRB Contract No. 2-815-04-225

July 1985

EXECUTIVE SUMMARY

1. INTRODUCTION

This report presents the results of Increments A, B, F, and G of the Energy Engineering Analysis Program conducted at Fort Gillem, Georgia, by JRB Associates under Contract No. DACA21-80-C-0014. This report includes analyses of the energy patterns at the facility, and the identification and evaluation of energy conservation opportunities. The results obtained indicate that current energy use at Fort Gillem has risen 80 percent over FY 1975 figures. This report is organized into 4 volumes plus appendices.

2. EXISTING ENERGY USE

Electricity, natural gas, and fuel oil are the main energy sources at Fort Gillem. In FY 1975 the total energy use at the Post was 233,700 MBtu. A summary of the FY 1984 basewide energy use and forecast 1985 by fuel type is given in Table 1, which shows that electricity currently accounts for approximately 66 percent of total energy use. Total energy use at the Post for the years 1975 to 1984 is shown in Table 2.

Early work in this study emphasized energy use in buildings. Initial data for the study were gathered through a series of site visits during which buildings were inventoried, patterns of building energy use were identified, and typical buildings were selected for detailed study in each category. Energy use data was analyzed to determine how much energy the various types of buildings use and their functional energy use. Since this effort took place in 1980, FY 1979 energy use data was the basis of the analysis. Figures 1, 2, 3, and 4 provide a summary of the building inventory and energy use in FY 1979. The energy profiles in these figures were developed by evaluating the energy use of typical buildings and expanding those values to represent the entire Post.

3. ENERGY CONSERVATION MEASURES DEVELOPED

The energy conservation opportunities at Fort Gillem are summarized in Table 3. This table shows all projects recommended and the resulting economic

TABLE 1. ENERGY USE AT FORT GILLEM - FY 1984

| ENERGY SOURCE | PURCHASED ENERGY | SOURCE USE |
|----------------|------------------|--------------|
| Electricity | 24,256,000 kWh | 281,370 MBtu |
| No. 2 Fuel Oil | 50,600 gallons | 7,018 MBtu |
| Natural Gas | 1,332,437 therms | 133,244 MBtu |

TABLE 2. ANNUAL ENERGY USE AT FORT GILLEM - FY 1975 - 1984 (MBtu)*

| ENERGY SOURCE | FY 1977 | FY 1978 | FY 1979 | FY 1980 | FY 1981 | FY 1982 | FY 1983 | FY 1984 |
|----------------|---------|---------|---------|---------|---------|---------|---------|---------|
| Electricity | 177,000 | 177,000 | 186,005 | 183,930 | 198,184 | 224,799 | 258,949 | 281,370 |
| No. 2 Fuel Oil | 38,000 | 57,000 | 68,219 | -- | -- | 85,695 | 108,076 | 133,244 |
| Natural Gas | 125,000 | 131,000 | 121,643 | 99,745 | 95,571 | 95,851 | 6,713 | 7,018 |

SOURCE: Facilities Engineers, Fort Gillem, GA, written communication

*FY 1975 total use 233,700 MBtu - use by individual energy source was not available.

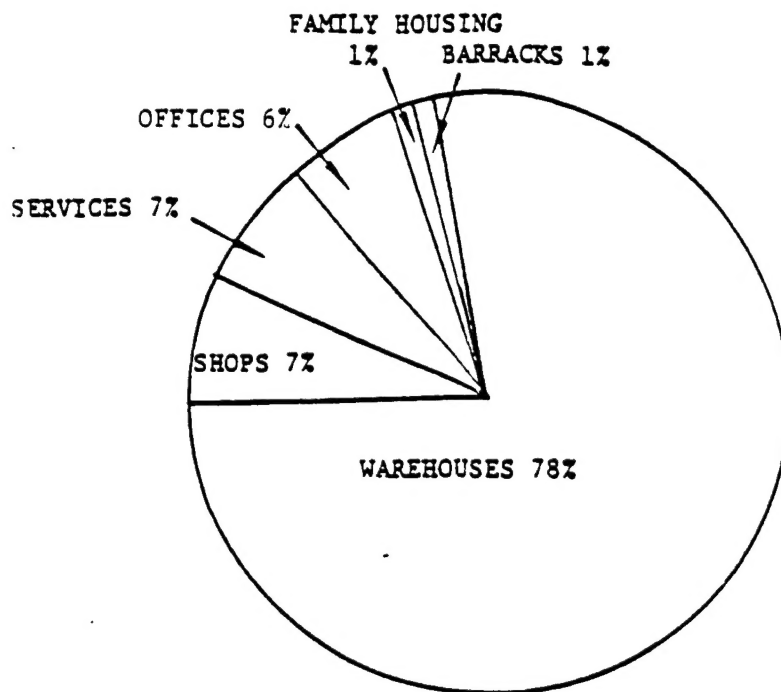


FIGURE 1. FLOOR AREA PROFILE BY BUILDING CATEGORY (FY 1979)

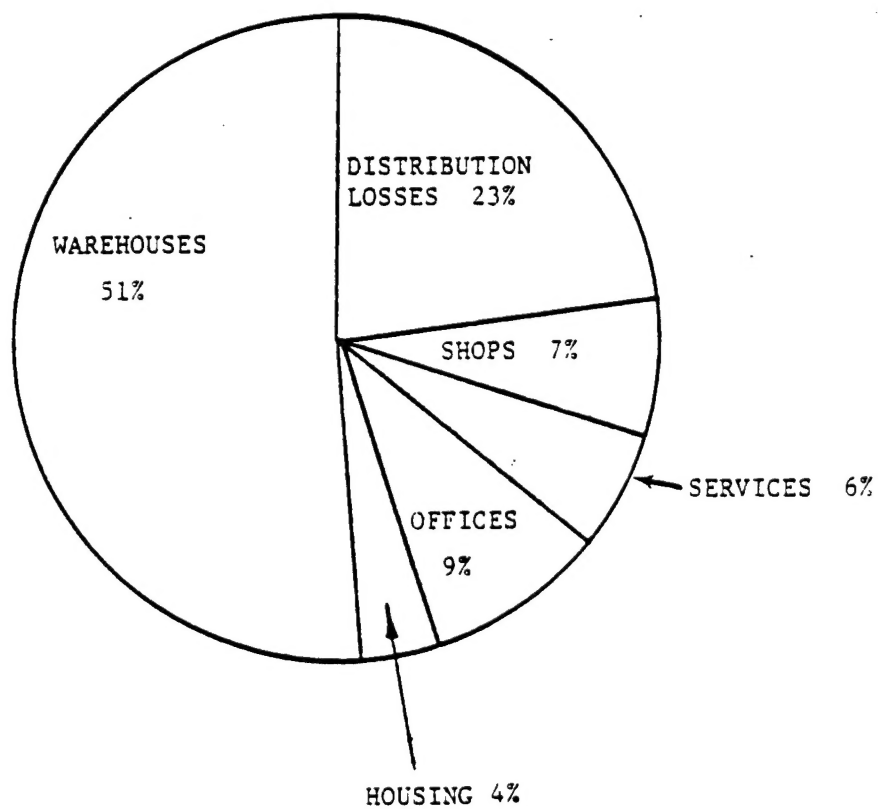


FIGURE 2. ENERGY USE BY BUILDING CATEGORY (FY 1979)

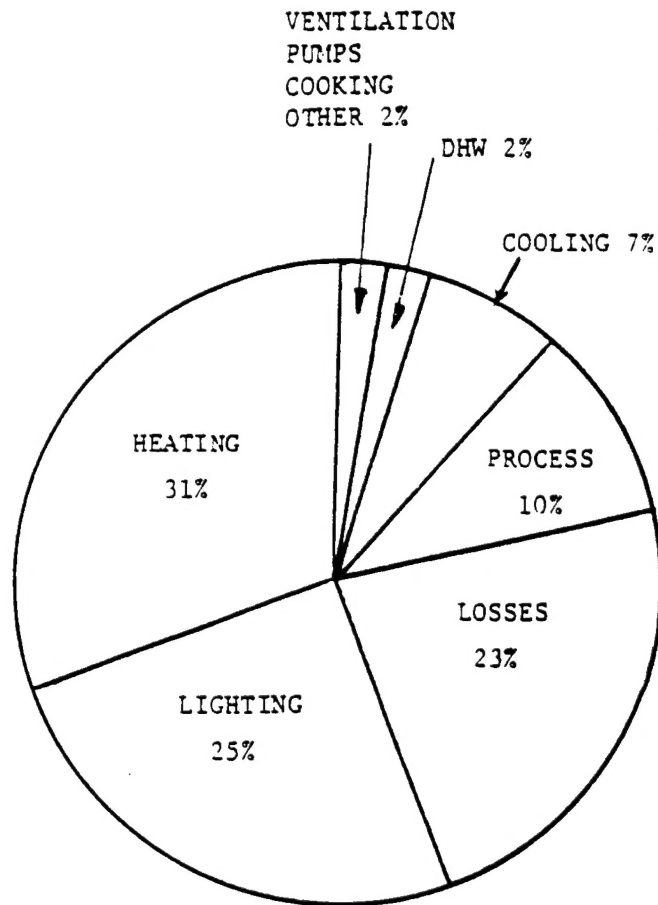


FIGURE 3. ENERGY USE BY BUILDING SYSTEM (FY 1979)

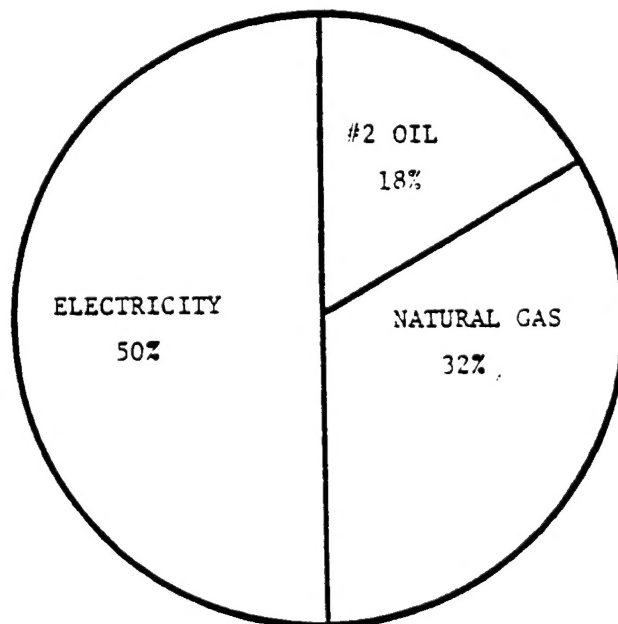


FIGURE 4. ACTUAL ENERGY USE (FY 1979)

TABLE 3. ENERGY CONSERVATION OPPORTUNITIES - FORT GILLEM

| INCREMENT PROJECT DESCRIPTION | E/C | ECONOMIC INDICIES | | | | ENERGY SAVINGS (MBTU) | | TOTAL | CWE (\$) | ANNUAL SAVINGS (\$) |
|---|-------|-------------------|---------------|------------------|----------|-----------------------|--------|--------|-----------|---------------------|
| | | SIR OR B/C* | PAYBACK (YRS) | FUNDING CATEGORY | FUEL OIL | NAT. GAS | ELEC. | | | |
| F REDUCE STRATIFICATION HEAT LOSSES | --- | 20.1 | 1.20 | QRIP | --- | 2,074 | -143 | 1,931 | 12,848 | 11,035 |
| F REDUCE INFILTRATION | --- | 15.8 | 1.50 | QRIP | --- | 1,975 | --- | 1,975 | 15,257 | 10,353 |
| G TEMPERATURE SETBACK: FAMILY HOUSING UNITS | 216.0 | 14.9* | 0.8 | OLM | --- | 128 | --- | 128 | 591 | 714 |
| F SHOWER FLOW RESTRICTORS | --- | 14.2 | 1.60 | QRIP | --- | 407 | 333 | 740 | 4,279 | 3,069 |
| F ENERGY CONSERVING FLUORESCENT LAMPS (EACH) | --- | 5.7 | 3.50 | OLM | --- | --- | 0.15 | 0.15 | 1.20 | 0.67 |
| A REDUCE TEMPERATURE STRATIFICATION | --- | 5.2 | 3.90 | ECIP | 11,533 | 5,156 | -1,761 | 14,928 | 412,698 | 106,976 |
| G HIGHER EFFICIENT LIGHT SOURCES: F.H., BARRACKS, GYM | 61.7 | 5.1* | 3.36 | OLM | --- | --- | 371 | 371 | 6,018 | 1,786 |
| F ELECTRONIC BALLASTS (EACH) | --- | 4.8 | 1.70 | OLM | --- | --- | 2.1 | 2.1 | 12.00 | 7.00 |
| F HEAT RECOVERY FROM A/C (DESUPERHEATERS) | --- | 4.6 | 5.10 | OLM | --- | 569 | --- | 569 | 15,685 | 3,083 |
| A LOADING DOCK CURTAINS | --- | 3.6 | 3.72 | ECIP | 8,937 | 5,958 | --- | 14,895 | 344,176 | 92,637 |
| A ENERGY CONSERVATION OPPORTUNITIES FOR VARIOUS BUILDINGS | 26.7 | 2.6* | 6.10 | ECIP | 48 | 4,678 | 2,050 | 6,776 | 253,499 | 41,526 |
| A CEILING INSULATION | 17.0 | 2.2* | 8.73 | ECIP | 143 | 1,838 | 34 | 2,015 | 118,863 | 13,609 |
| F HIGH EFFICIENCY MOTORS (EACH) | --- | 1.8 | 5.20 | OLM | --- | --- | 20 | 20 | 233 | 45 |
| G STORM WINDOWS: F.H. | 14.9 | 1.6* | 11.99 | OLM | --- | 138 | --- | 138 | 9,275 | 774 |
| G REPLACE PILOTS WITH SPARK IGNITION: F.H. | 16.6 | 1.2* | 10.79 | OLM | --- | 18 | --- | 18 | 1,086 | 101 |
| A SECURITY LIGHTING** | --- | .3 | 9.40 | NR | --- | --- | 2,313 | 2,313 | 120,693 | 7,790 |
| TOTAL | | | | | 20,661 | 22,939 | 884 | 44,484 | 1,194,275 | 285,663 |

* THIS DESIGNATES B/C VALUE

** THIS REVISED ECIP NO LONGER MEETS ECIP CRITERIA AND IS NOT RECOMMENDED FOR IMPLEMENTATION. VALUES SHOWN ARE NOT INCLUDED IN TOTALS

1 - 50 HOURS/WEEK OPERATION - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS

2 - 2 BULB 40 WATT FIXTURE AT 168 HOURS/WEEK OPERATION - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS

3 - 25 hp MOTOR AT 50 HOURS/WEEK USE - REPLACE AT FAILURE - NOT INCLUDED IN TOTALS

indices. These energy conservation opportunities were developed by analyzing their applicability to typical buildings. Those that met ECIP criteria were developed into projects with appropriate documentation (DD Forms 1391 and PDB). Table 4 provides a listing of the recommended ECIP projects. Other recommended energy conservation projects identified by JRB are listed in Table 5.

4. ENERGY AND COST SAVINGS

The total energy savings potential of the recommended energy conservation projects is 44,484 MBtu per year. This represents an estimated energy cost savings of \$285,600.

5. RESULTS OF INCREMENT A - BUILDINGS

The scope of Increment A included an engineering analysis of all existing buildings and processes at Fort Gillem. For each type of building, specific characteristics having a significant effect on energy use were identified. Table 6 shows these characteristics. The energy use of these buildings is identified in that table. Based upon these analyses, energy conservation projects were evaluated using ECIP criteria to determine acceptability. The recommended ECIP projects developed under Increment A are identified in Table 4.

6. RESULTS OF INCREMENT B - DISTRIBUTION SYSTEMS, EMCS

The scope of Increment B involved an engineering analysis of the Post's utilities, energy distribution systems, the existing plants, and the potential for an EMCS. Load profiles for each energy source were performed. The annual energy use profiles for fossil fuels and electricity are presented in Figures 5 and 6. No projects for Fort Gillem were found under this study as the central boiler plants are relatively small, and energy conservation measures are usually economical only in large systems. In addition, an EMCS project was not recommended because it would be applicable only to a limited number of buildings (less than 20).

TABLE 4. ENERGY CONSERVATION INVESTMENT PROGRAM PROJECTS

| INCRE- MENT | PROJECT DESCRIPTION | E/C | SIR OR B/C* | PAYBACK (Yrs) | FUNDING CATEGORY | TOTAL (MBtu) | CWE (\$) | ANNUAL SAVINGS (\$) |
|----------------|---|------|----------------|------------------|---------------------|-----------------|-------------|---------------------------|
| A | Loading Dock Curtains | -- | 3.6 | 3.7 | ECIP | 14,895 | 344,176 | 92,637 |
| A | Reduce Temperature Strati- fication | -- | 5.2 | 3.9 | ECIP | 14,928 | 412,698 | 106,976 |
| A | Energy Conservation Oppor- tunities for Various Buildings | 26.7 | 2.6* | 6.1 | ECIP | 6,776 | 253,499 | 41,526 |
| A | Ceiling Insulation | 17.0 | 2.2* | 8.73 | ECIP | 2,015 | 118,863 | 13,609 |
| A | Security Lighting** | -- | 0.8 | 9.40 | -- | 2,313 | 120,693 | 7,790 |
| | TOTAL | | | | | 38,614 | 1,132,236 | 254,748 |

*This designates B/C value.

**This revised ECIP no longer meets ECIP criteria and is not recommended for implementation.
Values shown are not included in totals.

TABLE 5. INCREMENT G CONSERVATION INVESTMENT PROGRAM PROJECTS

| PROJECT DESCRIPTION | SIR OR B/C* | PAYBACK (Yrs) | TOTAL (MBtu) | CWE (\$) | ANNUAL SAVINGS (\$) |
|---|----------------|------------------|-----------------|-------------|---------------------------|
| Temperature Setback: Family Housing Units | 14.9* | 0.8 | 128 | 591 | 714 |
| Higher Efficient Light Sources: F.H., Barracks, Gym | 5.1* | 3.36 | 371 | 6,018 | 1,786 |
| Storm Windows: F.H. | 1.6* | 11.99 | 138 | 9,275 | 774 |
| Replace Pilots with Spark Ignition: Family Housing | 1.2* | 10.79 | 18 | 1,086 | 101 |
| TOTAL | | | 655 | 16,920 | 3,375 |

*This designates B/C value.

TABLE 6. FORT GILLEM BUILDING SUBGROUPS

| CATEGORY | SUBGROUP | TYPICAL BUILDING | AREA IN SUBGROUP (square feet) | WALL TYPE |
|---------------|----------|------------------|--------------------------------|---|
| A. Offices | A-1 | 101 | 109,691 | Brick Brick Wood Wood |
| | A-2 | 102 | 38,475 | |
| | A-3 | 841 | 19,430 | |
| | A-4 | 906 | 66,135 | |
| | Subtotal | | 233,731 | |
| B. Dining* | | | | |
| C. Housing | C-1 | 139 | 24,423 | Brick Wood |
| | C-2 | 804 | 48,530 | |
| | Subtotal | | 72,953 | |
| D. Warehouses | D-1 | 308 | 293,932 | Block Brick Brick |
| | D-2 | 309 | 1,623,723 | |
| | D-3 | 507 | 1,206,371 | |
| | Subtotal | | 3,124,026 | |
| E. Shops | E-1 | 110 | 32,509 | Brick Block Metal |
| | E-2 | 400 | 104,078 | |
| | E-3 | 922 | 144,351 | |
| | Subtotal | | 280,938 | |
| F. Other | F-1 | 133 | 17,156 | Block Brick Wood Block Wood |
| | F-2 | 207 | 191,997 | |
| | F-3 | 918 | 18,079 | |
| | F-4 | 935 | 35,308 | |
| | F-5 | 942 | 8,407 | |
| | Subtotal | | 270,947 | |
| | TOTAL | | 3,982,595 | |

* No troop dining facilities exist at Fort Gillem. Clubs and snack bar facilities were included in Category F

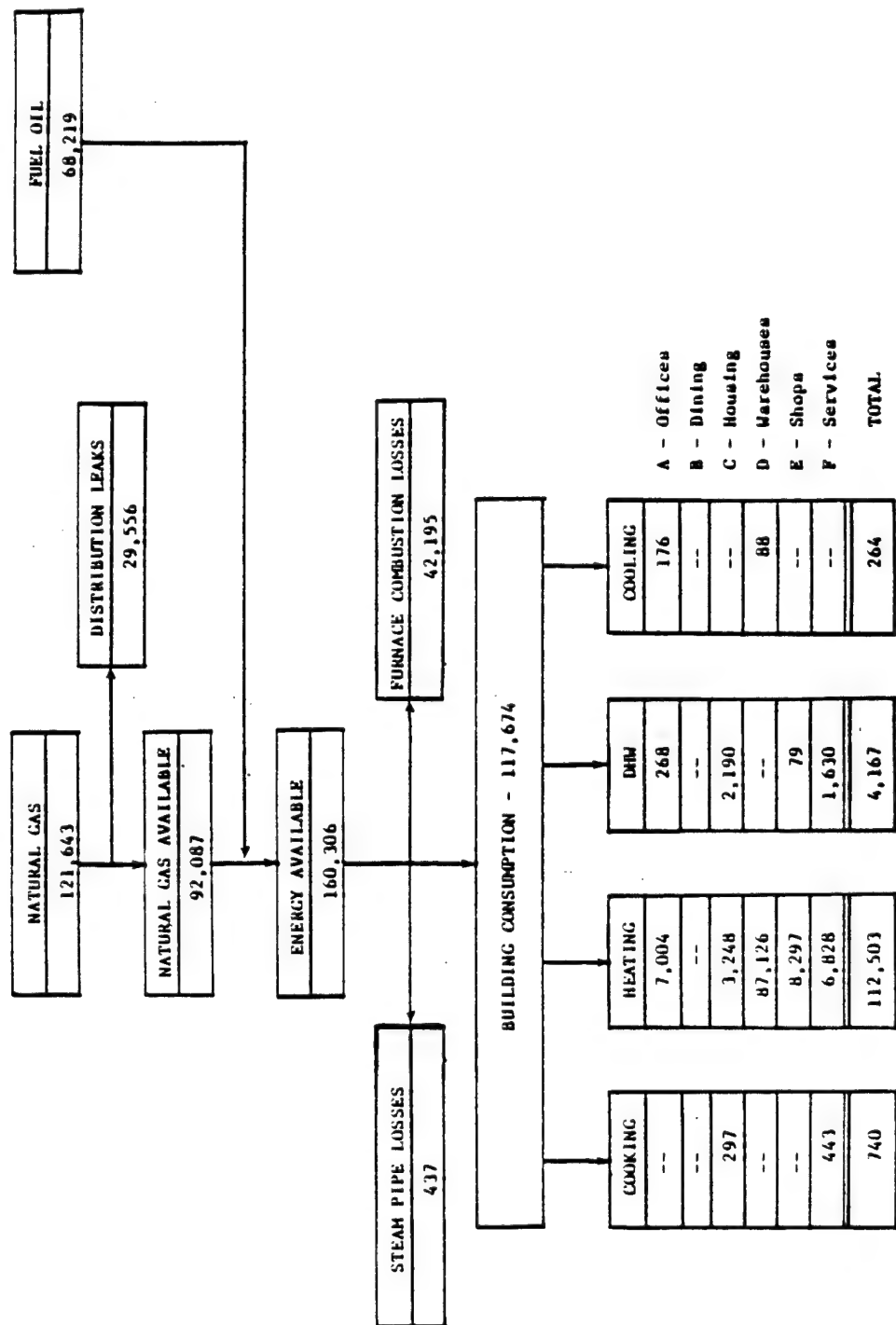


FIGURE 5. BUILDING ENERGY USE OF NATURAL GAS AND FUEL OIL BY BUILDING ENERGY SYSTEM
(Reference Appendix D, Increment A report)

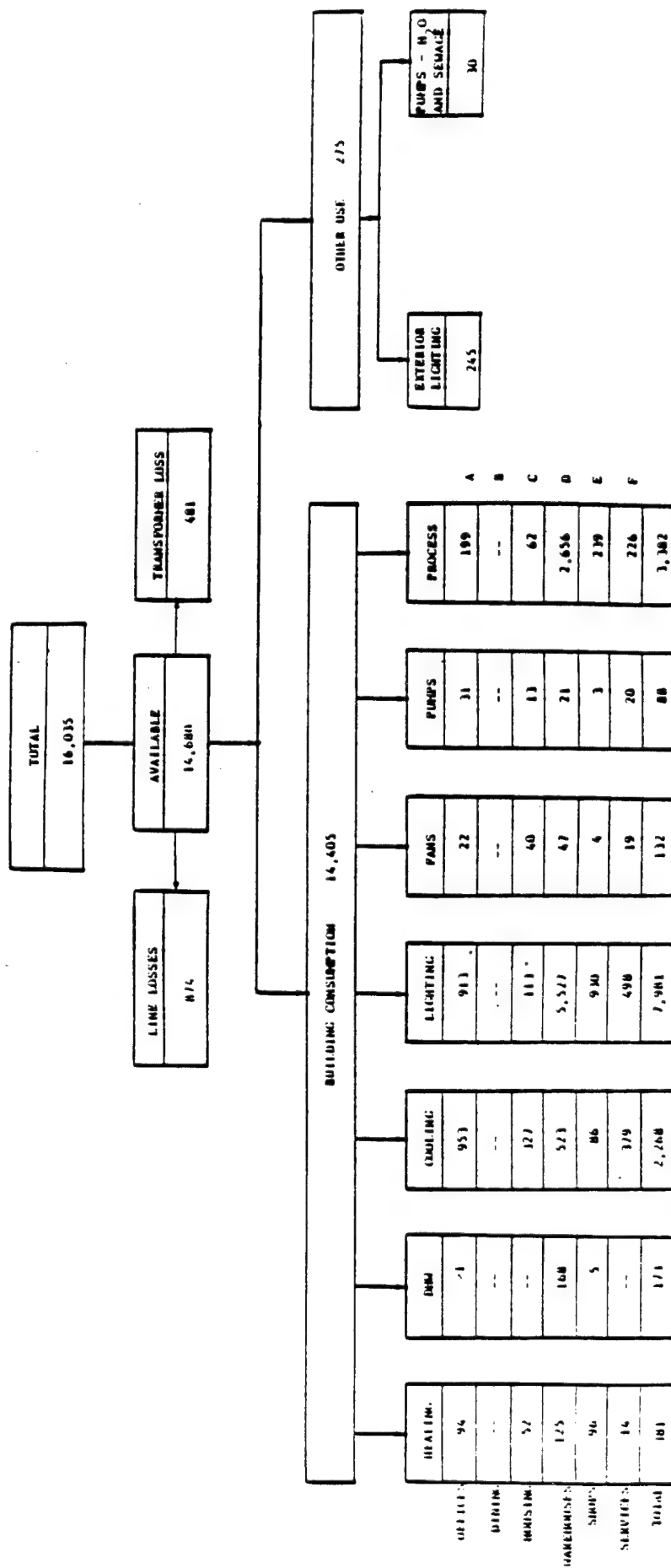


FIGURE 6. BUILDING ENERGY USE OF ELECTRICITY (In kWh x 10³ Per Year)

7. RESULTS OF INCREMENT F - FACILITY ENGINEER CONSERVATION MEASURES

The scope of work under Increment F is the identification of energy conservation opportunities that are within the Facilities Engineer funding authority, or which satisfy QRIP, OSD PIF, or PECIP requirements. In the performance of the Increment F evaluation, 19 buildings on Post were evaluated and four infiltration tests were performed.

Another element of the Increment F report is to identify the energy conservation measures accomplished by the Post since 1975. There were two major energy conservation actions taken by the Post. These are:

- Shutdown of major heating, lighting, and cooling systems when buildings are not in use; and
- Shutdown of utilities in unoccupied buildings.

These actions have resulted in a significant energy-use reduction. The recommended Increment F projects are presented in Table 7.

8. RESULTS OF INCREMENT G - MINOR CONSTRUCTION PROJECTS AND CHANGES IN OPERATION AND MAINTENANCE

The scope of work for Increment G was to identify cost-effective energy saving projects which do not qualify for ECIP funding. Increment G work was performed in conjunction with Increments A and B. The recommended projects are listed in Table 5.

9. ENERGY PLAN

A summary of the impact of JRB-recommended energy conservation projects and future Post actions on annual energy use is presented in Table 8. The estimated annual energy use increase comparing FY 1975 values to FY 1985 is 80 percent. Table 9 shows FY 1985 projected energy use by fuel type.

A comparison of annual energy use per square foot of Fort Gillem floor area is shown in Table 8. The projected percent change from FY 1975 to FY 1985 is a 21 percent decrease.

TABLE 7. RECOMMENDED ENERGY CONSERVATION OPPORTUNITIES AT FORT GILLEM

| ENERGY OPTION | FUNDING | COST (\$) | ENERGY SAVINGS (MBtu) | ANNUAL COST SAVINGS (\$) | SIR | SIMPLE PAYBACK PERIOD (YEARS) |
|---|---------|-----------|-----------------------|--------------------------|------|-------------------------------|
| Reduce Stratification Heat Losses | QRIP | 12,848 | 1,931 | 11,036 | 20.1 | 1.2 |
| Reduce Infiltration | QRIP | 15,257 | 1,975 | 11,258 | 15.8 | 1.4 |
| Shower Flow Restrictors | QRIP | 4,279 | 740 | 3,069 | 14.2 | 1.4 |
| Energy Conserving Fluorescent Lamps (each) ¹ | O&M | 1.20* | 0.15* | 0.67* | 5.7 | 3.5 |
| Electronic Ballasts (each) ² | O&M | 12.00* | 2.1* | 7* | 4.8 | 1.7 |
| Heat Recovery from A/C (Desuperheater) | O&M | 15,685 | 569 | 3,083 | 4.6 | 5.1 |
| High Efficiency Motors (each) ³ | O&M | 233* | 20* | 45* | 1.8 | 5.1 |
| TOTAL | | 48,069 | 5,215 | 28,446 | | |

*Not included in totals.

¹50 hours/week operation - replace at failure.

²Two bulb 40 watt fixture at 168 hours/week operation - replace at failure.

³25 hp motor at 50 hours/week use - replace at failure.

TABLE 8. ENERGY USE, ACTUAL AND PROJECTED, WITH PERCENTAGE OF INCREASE

| FY | 1975 | 1982 | 1983 | 1984 | % INCREASE FROM 1975 (OVER PROJECTED 1984) USE 1985 | | % INCREASE FROM 1975 |
|--|---------|---------|---------|---------|--|---------|-------------------------|
| | | | | | | | |
| Energy Use 10 ⁶ Btu/yr | 233,700 | 406,345 | 373,738 | 421,632 | 80.4 | 421,146 | 80.2 |
| Square Feet (x10 ³) | 6,413 | -- | -- | 5,082 | -20.8 | 5,066 | -21.0 |
| Energy (10 ⁶) Use per sq.ft. | 0.0264 | -- | -- | 0.0830 | 128.0 | 0.0831 | 128.4 |

TABLE 9. FORECAST ENERGY USE BY FUEL TYPE

| FUEL TYPE | 1984 ENERGY USE (MBtu) | ENERGY REQUIRED BY NEW CONSTRUCTION (MBtu) | DEMOLITION (MBtu) | 1985 FORECAST (MBtu) |
|-------------|---------------------------|--|----------------------|-------------------------|
| Electricity | 281,370 | -- | (-355) | 281,015 |
| Natural Gas | 133,244 | -- | (-131) | 133,113 |
| #2 Fuel Oil | 7,018 | -- | 0 | 7,018 |
| Total | 421,632 | -- | (-486) | 421,146 |

10. RESULTS AND RECOMMENDATIONS

The quantity of energy use at Fort Gillem will continue to increase as long as warehouse space is converted to other type space requiring more comfortable temperatures. These trends can be reversed by accomplishing several major actions. They are:

- Maintain the current energy conservation program at the Post level;
- Continue to program and fund major energy conservation projects;
- Perform a leak test on natural gas mains; and
- Install meters on all tenant activities and bill according to use.

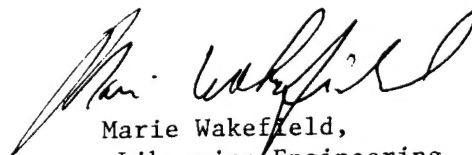


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